ORIGINAL ARTICLE

HYPOMAGNESAEMIA IN PROTEIN ENERGY MALNUTRITION

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ABSTRACT: INTRODUCTION: Protein energy malnutrition is one of the leading causes of childhood mortality and morbidity in developing countries.(1) It is a global health problem which starts in womb and ends in tomb. Protein energy malnutrition is a disease of multi-deprivation and poverty affecting nearly 150 million children under the age of 5 years in the world. Out of the 120 million children in India, 75 million are estimated to suffer from visible protein energy malnutrition.(2) Three countries, India, Bangladesh, Pakistan account for half of world's underweight children despite having just 29 percent of the developing world's under five population.(3) It is not only an important cause of childhood morbidity and mortality but leads to permanent impairment of physical and possibly of mental growth. Magnesium is essential for bio-energetic reactions controlling fuel oxidation, membrane transport and signal transmission contributing to the action of more than 300 enzymes.(4) It is important for membrane stabilization and nerve conduction. Adenosine triphosphate and Guanosine triphosphate (GTP) need associated magnesium when they are used by ATPases, cyclases and kinases. However hypomagnesaemia may produce hypokalaemia that only corrects with magnesium therapy(5) Magnesium deficiency may cause grave disturbances including neurologic signs such as twitching, tremors and convulsions(6) Magnesium decreases calcium uptake by the cells, inhibits smooth muscle contractility, inhibits histamine and acetyl choline release and depresses excitability of smooth muscle fibres. Thus it has bronchodilator and anti-inflammatory properties.(2) Magnesium modulates vasomotor tone, blood pressure and peripheral blood flow. Magnesium deficiency is known to trigger vasoconstriction and enhances vascular endothelial injury.(1,7) On the other hand ET-1(endothelin -1) is a potent vasoconstrictor peptide. Results of a previous study showed that the mean serum endothelin-1 levels in a group with low magnesium levels were significantly higher than that of group with normal magnesium levels in malnourished children($p<0.05$).(8) An article cites evidence in support of a hypothesis that a fall in magnesium levels triggers a temporal sequence of events involving vasoconstriction, hemodynamic alterations and vascular endothelial injury to produce pro-inflammatory, pro- oxidant and pro-fibrogenic effects resulting in initial perivascular myocardial damage and replacement fibrosis.(7) Dietary magnesium deficiency is more prevalent than generally suspected and can cause cardiovascular lesions leading to diseases in all stages of life. Magnesium deficiency leads to cardiac arrhythmias that are refractory unless magnesium is added to regimen.(9) Rich sources of magnesium include legumes, nuts, bananas and whole grains.(4) So knowing the patho-physiology of magnesium deficiency in human body it is very clear the damage that occurs in a malnourished child who is already in a oxidative stress. As a result this study will help us to know the poor outcome of protein energy malnutrition child with hypomagnesaemia (serum magnesium level <1.5mg/dl).

KEYWORDS: Hypomagnesaemia, Protein Energy Malnutrition.

INTRODUCTION: AIM AND OBJECTIVE OF THE STUDY: To assess hypomagnesaemia in a protein energy malnourished child.

PATIENTS AND METHODS: Patients: Children aged between 1year to 5years (admitted in RIMS Paediatric Department) with protein energy malnutrition classified under Indian Academy of Paediatrics classification.

STUDY PERIOD: August 15th 2012 to August 15th 2013.

Materials and Methods of study: It is a prospective study and assesses the association of hypomagnesaemia in children with protein energy malnutrition.

About 2ml of blood drawn under aseptic conditions in a sterile autoclaved blood sample bottle and labeled with patient's name, age, sex and the date of collection of sample.

Then the blood sample is centrifuged and serum separated out. The test is run immediately to find out the magnesium levels or the serum sample is stored between 2^0 C – 8^0 C in a refrigerator (for a maximum period of 10 days). This is done in order to collect a few samples and run them altogether.

The Magnesium levels are assessed with the help of an Autoanalyser. Initially the quality control is done and the calibration carried out according to the instructions given in the Reagent kit. Then reagent is added to the serum sample and the test is run to obtain the magnesium levels.

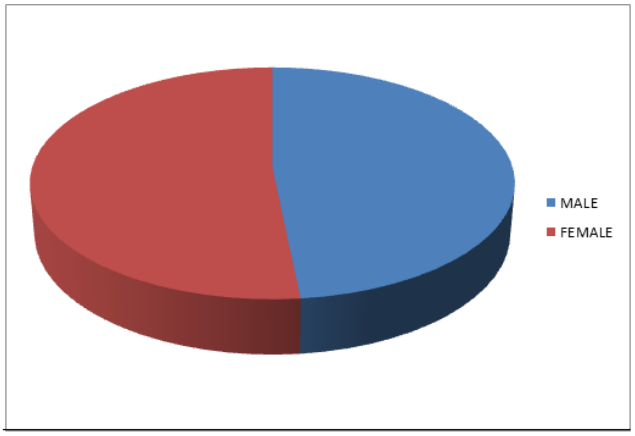
DISCUSSION: Protein energy malnutrition is not just a protein and calorie deficiency but range of pathological conditions arising from coincidence lack of proteins, calories, vitamins and minerals.

As magnesium plays a very important role in haemostasis and is a cardio-protective drug its deficiency leads to increased mortality in a malnourished child who is already suffering from multifactorial deprivation, oxidative stress, infections and complications. So this study will definitely help us to study the importance of low magnesium levels in protein energy malnutrition child for appropriate management both prophylactically and treatment proper to be done to decrease the morbidity and mortality rate in such children.

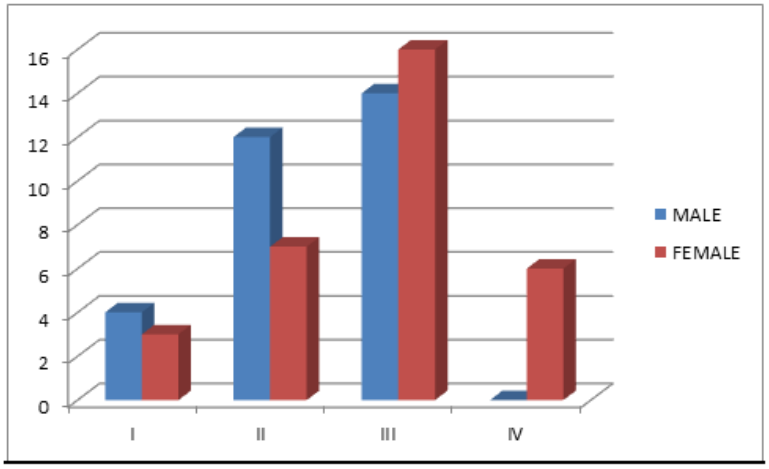
DATA ANALYSIS:

- A total of 62 cases were studied out of which 30 are males and 32 are females
- Out of the 62 cases 32 are grade III PEM children.
- Out of the 62 children in the study, 17 children were found to have low magnesium levels (<1.5 mg/dl) and one death was recorded during the study period.

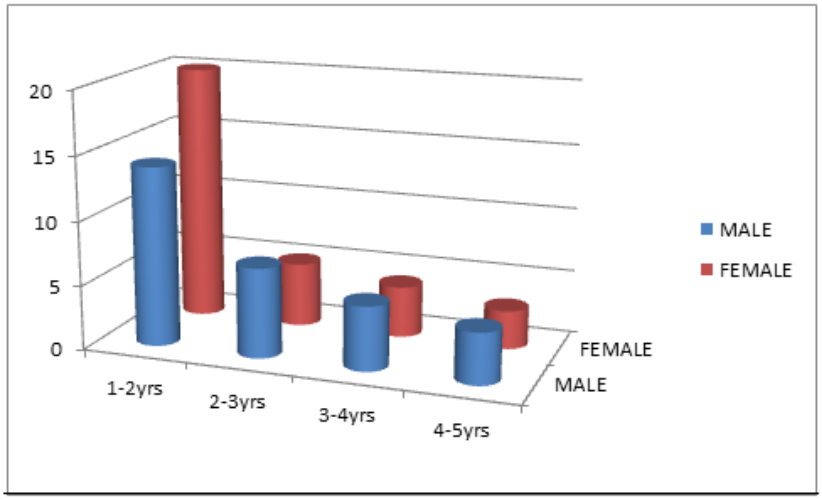
Male	Female	Total
30	32	62



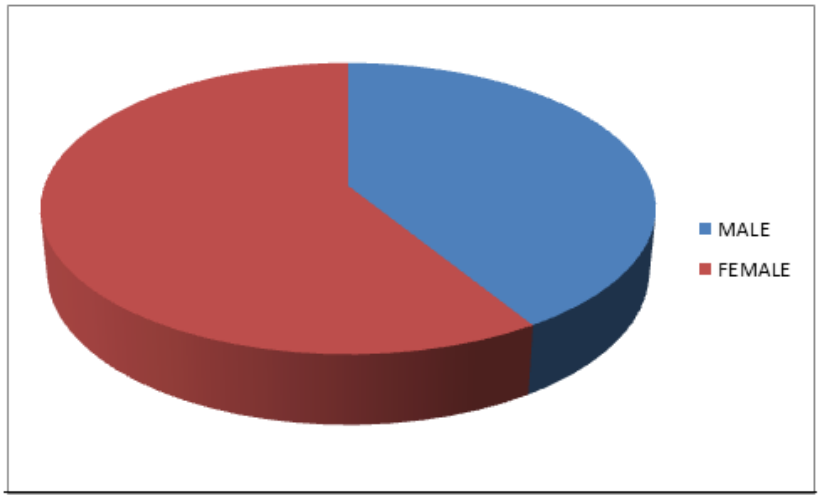
Grade	Male	Female
I	4	3
II	12	7
III	14	16
IV	0	6



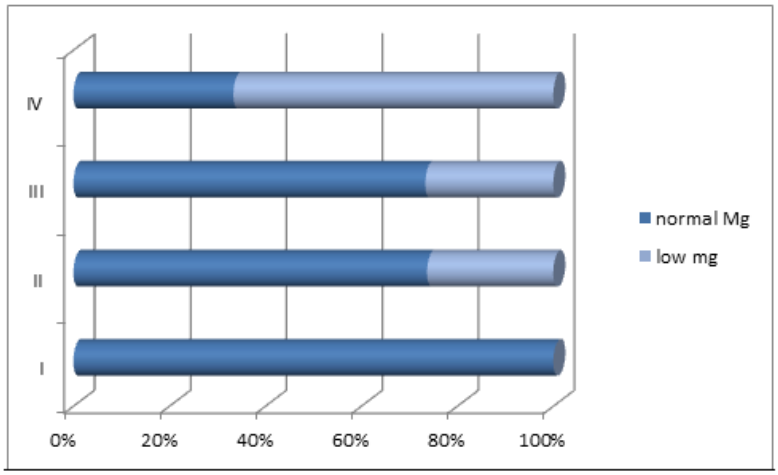
Age	Male	Female
1-2 yrs	14	20
2-3 yrs	7	5
3-4 yrs	5	4
4-5 yrs	4	3



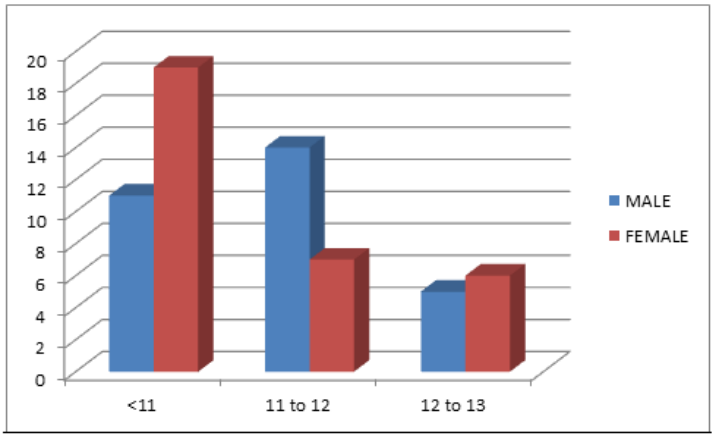
Male	Female
7	10
Low magnesium levels	



Grade	Normal Mg	Low Mg
I	7	0
II	14	5
III	22	8
IV	2	6



MAC	Males	Females
<11	11	19
11-12	14	7
12-13	5	6



STATISTICAL ANALYSIS: The test of significance adopted for this study is ANOVA (Analysis of variance). This test was applied for the 62 values and the mean and standard deviation for the values according to the grade of PEM is as follows;

Grade	Mean	SD	Variance
I	2.02	0.31	0.0961
II	1.77	0.48	0.2304
III	1.69	0.42	0.1754
IV	1.33	0.33	0.1089

The P value was found to be 0.034 ($P<0.05$ is significant).
Hence found to be statistically significant.

INFERENCES AND CONCLUSION: In this study 17 out of 62 PEM children were found to have low magnesium levels (27% of the study population) out of which 10 are females.

About 50% of the study population belongs to Grade III PEM.

In this study >50% of the children were in the age group of! to 2 years which is the most vital period for neuro-development and hence any nutritional deficiency in this age group should be treated at the earliest.

The percentage of children with low magnesium levels in grade II, III, IV PEM are 26%, 27% and 66% respectively. Hence greater the severity of PEM, lower is the magnesium levels.

The study of hypomagnesaemia (serum Magnesium level <1.5mg/dl) in protein energy malnourished children will help us to have an insight of role of micronutrients in maintaining the normal metabolism in our body as well as the above nutrient magnesium supplementation appropriately can decrease the morbidity and mortality rates in malnourished children and helps in better recovery of a PEM child.

ENCLOSURE 1: Informed consent of patient.

ENCLOSURE 2: Proforma.

INFORMED CONSENT: I Dr.Nasima Banu, MD Paediatrics, Assistant Professor, Department of Paediatrics, RIMS, Raichur would like to invite you to take part in the research study titled "hypomagnesaemia in protein energy malnutrition" conducted by Ramya. R, medical student of RIMS at paediatric ward, RIMS Teaching Hospital.

PURPOSE: To estimate the deficiency of magnesium in all protein energy malnourished children according to the IAP and assess the hypomagnesaemia in these children and provide proper nutritional supplementation to these children.

DESCRIPTION: The basic information of the child along with the anthropometric measurements like height, weight, mid-arm circumference, head circumference and chest circumference are collected, then the blood sample of the child is collected in a sterile bottle

RISKS: No risks are associated with the study.

POTENTIAL BENEFITS:

1. Hypomagnesaemia is a prognostic factor in protein energy malnourished children.
2. It helps us to assess the mortality risks in all protein energy malnourished children especially in severely malnourished children.
3. It is of importance in order to supplement all malnourished children with micronutrients.
4. The results of the study can be extended to the community.

UNDERSTANDING:

1. I have read the information sheet and have had an opportunity to discuss this study and ask questions for which I have received satisfactory answers.
2. I have received enough information about the study.
3. I understand that I am free to withdraw from the study at any time, without having to give reason and without affecting my future medical care.
4. Sections of my medical notes, including those held by the investigators relating to my participation in this study may be examined by other research assistants and the same can be published in journals without revealing the identity. All personal details will be treated as STRICTLY CONFIDENTIAL. I give my permission for these individuals to have access to my records.
5. I have had sufficient time to come to my decision.

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